Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/454
UNITED ARAB REPUBLIC
February 1964
Original: ENGLISH

Confidential until official release during Conference

Abstract

REACTORS GRADE URANIUM FROM UAR MONAZITE BY NEWER TECHNOLOGIES

Part I: The chalk-sintering complex choride fixation approach

Part II: The Trilaurylamine direct treatment of rare-earth barren digests

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Both acid and alkali processes for separating reactor grade uranium, thorium or high purity individual rare-earths suffer the drawbacks of:

- lengthy fractionation in phosphate presence;
- excessive grinding before alkali leaching;
- necessity of using few solvents for refining either thorium or uranium to reach nuclear purity grades by expensive and elaborate lengthy devices.

The present investigation describes two new approaches:

Part I: The chalk sintering - hydrochloric acid leaching and ion-exchange uranium fixation as chloride complex, followed by wet reduction to uranium dioxide or fluorination.

This is a modification of the French alkali patent whereby:

- grinding and dressing of 98% monazite to -325 mesh powder is replaced by sintering at 825°C using various fluxes particularly chalk;
- after serubbing the sinter, leaching of monazite by volume to volume HCl;
- saturating the liquor by commercial salt and adjusting its EMF to 0.4 volt;
- fixing the complex uranyl chloride on an ion-exchange resin strong base;
- washing the column from thorium and rare-earth by 2.5 bed volume 1:1 HCl then eluting uranium by pH 1 acid HCl or fluoride;

- reduction by versatile reductors and wet precipitation of uranium dioxide fuel material;
- eventual refining of chloride eluates as such by TBP or TLA/MIK.

Part II: The extraction of reactor grade uranium directly by Trilaurylamine on the rare-earths barren monazite digests.

This is an original modification of the AMEX process:

- by adjusting digests of sulphate attacks of monazite to pH 1.1 by various means to strip majority of thorium, keeping liquors only rare-earth barren;
- following this by extracting uranium through Trilaurylamine sulphate, while defining parameters, optimal conditions, drawing isotherms as also investigating the kinetics of the system and number of theoretical stages according to McCabe-Thiele's diagrams;
- presenting bench-scale batch and continuous mixer-settler data for uranium refining as well as spectrographic analyses for their specifications fulfilment.